ECE482 — Introduction to Operating Systems

Homework 1
Manuel — JI (Fall 2024)

ECE4820 Exercises

Ex. 1 — *Review*

Explain the difference between the *stack* and the *heap*.

Ex. 2 — *Personal research*

1. Briefly explain what operations are performed when a computer is powered on. What is the role of the BIOS and how does it interact with the OS?

2. In a few words explain what are hybrid and exo kernels.

Ex. 3 — *Course application*

1. Which of the following instructions should only be allowed in kernel mode? Explain.

   a) Disable all interrupts

   b) Read the time-of-day clock

   c) Set the time-of-day clock

   d) Change the memory map

2. Consider a system that has two CPUs and each CPU is composed of two threads. Suppose three programs, P0, P1, and P2, are started with run times of 5, 10 and 20 ms, respectively. How long will it take to complete the execution of these programs? Assume that all three programs are 100% CPU bound, do not block during execution, and do not change CPUs once assigned.

Ex. 4 — *Command lines on a Unix system*

On Linux use the command line to:

1. Create a new user;

2. List all the currently running processes;

3. Display the characteristics of the CPU and the available memory;

4. Redirect random output read from a system device, into two different files;

5. Concatenate the two previous files;

6. Read the content of the resulting file as hexadecimal values (in other words find a command to read a file as hexadecimal values);

7. Go at the root of the kernel source you downloaded in l2 and use a single command to find all the files in with the word `mutex` in their name and containing the whole word `nest_lock`;

Note: follow the "programming exercises" guidelines and save the list of commands in a shell file (`.sh`).

Ex. 5 — *Simple problem*

One reason GUIs were initially slow to be adopted was the cost of the hardware needed to support them. How much video RAM is needed to support a 25 lines by 80 rows character monochrome text screen? How much for a 1024 x 768 pixel 24-bit color bitmap? Assuming the cost of this RAM in the 1980es was \$5/KB what was the price of those two solutions? How much is it now?